



ANALYST INSIGHTS

Evolving home gateway architecture to enable the smart home



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How many devices in your home are attached to the Internet? I would be willing to make a bet that in most readers' households, we will easily find ourselves in double digits. This includes most devices that usually come to mind: laptops, tablets, and mobile devices. But it also includes media devices; smart TVs, game consoles, video delivery set-top boxes, and wireless speakers. It probably also includes a growing number of smart home devices; thermostats, indoor/outdoor cameras, security systems, baby monitors, and other peripheral devices. How many of those devices are connected to the home network via a wire? Probably not many, if any at all. In my own household, I have every single device

on my Wi-Fi network, and I imagine most of you do as well. Wi-Fi is no longer that nice-to-have convenience for wire-free Internet access on your laptop. It's the nexus of your connected home and life.

The consumer's broadband experience is defined by Wi-Fi performance. This is a problem for broadband service providers; Wi-Fi is currently a best-effort technology and its unpredictable, un-managed performance is a referendum on the quality of the broadband service they're supplying. The growth in smart home devices raises the stakes, with Wi-Fi increasingly used to control critical functions like heating, lighting, security and digital assistants. Reliably connecting and controlling these devices, alongside streaming media and other communication functions, is complicated and beyond the capabilities of the Wi-Fi CPE currently in subscribers' homes. Service providers' contractual obligations might end with access to the home, but they must deploy carrier-grade Wi-Fi solutions if they are to successfully deliver and monetize the smart, connected home opportunity.

Broadband service providers have concentrated their investment on bringing faster speeds to the home, but not connectivity inside the home. Consumers have fast speeds to the house but don't find these access speeds available wirelessly around the home. Home gateways complying with the 802.11ac Wi-Fi specification are widely deployed by providers, and have a theoretical maximum throughput of 1,300 Mbps. This is more than enough to handle the smart home, multiple 4K video streams, VoIP and many other functions concurrently, but unobtainable in real homes, with Wi-Fi performance heavily affected by:

- **Distance:** the further away a device is from the Wi-Fi access point, the weaker the signal and the slower the connection. In most broadband installations, the home gateway is installed by an engineer at an easy point of entry — often near an outside wall closest to the curb, without regard for optimal Wi-Fi performance for the house layout.

- **Physical obstructions:** Walls and other obstacles in the home impede the signal. The 5 GHz band generally offers more throughput than the 2.4 GHz band, but has a harder time penetrating obstacles and may not be available in some areas of the dwelling separated by more than a couple of walls from the access point.
- **Older protocols:** Each radio in the access point can only communicate with one device at a time, with each taking turns. The gateway must operate in slower legacy modes with older devices on the network that use the 802.11n or earlier protocols. This reduces the aggregate speed of the connection.
- **Interference:** The 2.4 GHz and 5 GHz Wi-Fi bands are unlicensed and the signal can be heavily degraded by interference from neighboring Wi-Fi networks and other devices using these bands. This is particularly a problem in apartment and multi-dwelling units. They are also subject to interference from other radio signals.

A single Wi-Fi access point cannot overcome all these issues and provide optimal coverage to the whole house. Wi-Fi service calls are the primary reason why users call their provider, so it is not just consumers feeling the pain of these issues.

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Given the above, the perfect Wi-Fi home network would have an access point in every room, with a wired ethernet backbone linking the access points to the main modem or ONT. This would enable each device

to be connected at the shortest possible distance, with no walls blocking the signal, isolating the impact of older devices to their nearest access point. However, given the capital cost inherent in such an ideal situation, we must look for other ways to optimize Wi-Fi with multiple CPEs.

This has led to consumers seeking their own solutions. Sometimes they buy a new router from their big box store, but that can lead to underperformance as it only helps to address the latest 802.11ac devices. Older client devices relying on other Wi-Fi protocols will still pull down the Wi-Fi throughput.

Consumers also turn to extenders, but these can cause more problems than they solve. As with anything in real estate, the key is location, location, location. Consumers often find a place where Wi-Fi is performing poorly, and simply place an extender there. Of course, this is too far from the gateway, in the dark coverage area of the house. The extender is operating with the same weak signal that is the original issue.

Further, there is an issue with how end devices communicate with the Wi-Fi network. When a device

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attaches to a Wi-Fi gateway or an extender, mobility within the home network becomes a problem. Attaching to a different access point is not automated, unless the connection to the original access point is lost entirely. Users must manually attach to the unique SSID of the extender to gain the Wi-Fi benefits. This problem multiplies if a user needs multiple extenders to cover a larger area. They might even be standing next to their brand-new Wi-Fi extender, and wondering why their Wi-Fi performance is terrible. This causes

frustration, and this means it is time to call their service provider.

Google, Eero, Plume, and Netgear among others spotted an opportunity in this space, and launched whole home Wi-Fi solutions in the retail space to address consumer demand. These products consist of multiple Wi-Fi nodes to be positioned around the home and operate as a mesh network. A mesh network is fundamentally different from deploying Wi-Fi extenders in its ability to optimally route traffic between nodes. It can replace the gateway or work in conjunction with it but it does not require more than one SSID. Further, mesh networks enable the handoff of the Wi-Fi signal dynamically. This allows consumers to move throughout their home and have their end device attach to the most efficient node in the home. Mesh Wi-Fi systems are typically easy to install and coupled with an app that assists consumers with the setup.

However, mesh by itself is not a panacea. Ultimately, it is a premium product that is targeting home owners with large houses, multiple floors and/or outbuildings. Nonetheless, the threat of retail CPE enabling the home Wi-Fi network cannot be understated. If a consumer recognizes that their home Wi-Fi is unsatisfactory for their needs, and shops retail for a solution, they are half-gone as a subscriber; Wi-Fi is the broadband connection now. If service providers lose that connection with the user, then they simply become a commoditized dumb pipe with little chance to monetize the smart home. This presents a chance for service providers to differentiate by making a premium managed mesh solution a part of their offering.

Simply connecting smart devices is not enough: there must be intelligence behind it. That intelligence must be managed by a home gateway and multiple devices directing Wi-Fi traffic around the home to where it needs to be.

So, what is the opportunity for service providers in this space? While service providers may only see additional capital expenditure for more devices in the home, there are multiple opportunities available:

- **Service upsells:** service providers can use a managed Wi-Fi solution as a means to convince customers to subscribe to a premium bandwidth tier. Alternatively, providers can rent or sell wireless access points at lower bandwidth tiers. This is the simplest way to increase revenue per household.
- **Competitive advantage:** service providers can also use managed Wi-Fi as a competitive differentiator. Promising to distribute that premium bandwidth subscription to all corners of the house is a compelling marketing strategy.
- **Network visibility:** deploying a managed Wi-Fi service gives the opportunity to actively monitor the home network. This includes data about the devices connected to the network, as well as how the network itself is being used. The provider can detect if a device is not optimized, or not working, as well as further understand their consumers' behavior. Google's interest is a prime indicator of the data and analytics opportunity.
- **Reduction of operating expenses:** This is always difficult to quantify, but the opportunity presented by the data and analytics of network visibility can help proactive, remote home network troubleshooting. Further, with an intelligent, self-healing Wi-Fi network, calls to customer service centers will reduce measurably. Truck rolls to repair network issues will be reduced. These will all have positive effects on operating expenses.
- **Ownership of the smart home:** this can be accomplished a couple of different ways. Service providers can choose to partner with smart home device vendors, and offer their technology to their subscribers. This has the benefit of control over the devices managed in the smart home. However, a compelling strategy is to ensure that the smart home can be managed with the premium Wi-Fi system. This ensures that the right devices are on the right Wi-Fi specifications. A multi-CPE household could even have devices with low power wireless such as Zigbee, Z-Wave, or Bluetooth incorporated with a software management system to ensure maximum efficiency.

In summary

The last mile bottleneck has shifted to the actual home network. When a customer is paying a premium for a higher bandwidth broadband connection, they expect that to translate to the Wi-Fi performance. That means it is in the providers' best interest to provide that premium Wi-Fi. To every room in the house. To the garage. And the backyard. Because the key is no longer capacity, which can be delivered to the wall. The lynchpin now is coverage, which requires a managed multiple-CPE whole-home Wi-Fi solution.